

BC Science

CONNECTIONS

STUDENT WORKBOOK



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BC Science CONNECTIONS 8

Student Workbook

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Safety Concepts

Use with textbook pages xiv-xvii.

Safety in your science class means knowing how to apply the safety rules, practicing safe lab procedures, and following your teacher's instructions. Safety is a way of thinking and acting. It involves how you behave with the equipment you use and the people you work with.

As you read each section, draw what you "See" or what you "Hear" in your head.

Draw What you "See or Hear"	Rules and Procedures
1. General rules	• Listen to and read all instructions. • Ask questions if you do not understand a step. • Identify the safety symbols and precautions in an experiment. • Know where to find and how to use the eye wash station, emergency deluge shower, fire extinguisher, fire blanket, and fire alarm. • Tell your teacher about allergies or anything else that could stop you from hearing, seeing, or doing the lab. • Wait for your teacher's permission to start working on any activity or investigation.
2. Acting responsibly	• Wear safety equipment such as goggles, gloves, and a lab apron as instructed by your teacher. • Tie back long hair, loose clothing, and dangling jewelry. • Never chew gum, eat, or drink in the science classroom. Do not taste or put anything in your mouth. • Carefully handle equipment. • Tell your teacher if something is not safe, especially if it is a chemical spill, broken equipment, or someone behaving unsafely. • Listen as the teacher describes all the safety issues and where to put waste materials. • Wash your hands before and after you handle any equipment and materials in investigations. • Clean up your workstation, return materials, equipment, and waste to the appropriate locations as directed by your teacher.
3. Working with sharp objects	• When cutting, move the scissors or the knife away from your body. • Keep safety guards on scalpels or any sharp tools until they are to be used. • When walking with sharp objects, like scissors or scalpels, carry them with pointed end downward, away from you and others. • Tell the teacher if the equipment is broken and has a sharp edge. Be careful with it. • Ask the teacher where to put broken glass.

Draw What you "See or Hear"	Rules and Procedures
4. Working with electrical equipment	• Dry your hands before touching electrical cords, plugs, or sockets. • Pull the plug, not the cord, when unplugging electrical equipment. • Tell the teacher if the electrical equipment is damaged. • Keep electrical cords away from where people walk.
5. Working with heat	• Always use heat-proof containers such as Pyrex® glassware. • Stay with the object as it is heated. Never leave heating objects unattended. • Point the end of a container being heated away from you and others. • Do not let a container boil dry. • Listen to your teacher explain how to safely light and use a Bunsen burner. • Hot objects do not look hot and they will burn you! Handle hot plates carefully. • If you burn yourself, immediately run cold water on the burn and tell your teacher.
6. Working with chemicals	• If a chemical spills on your... Body – Wash with water immediately at the closest emergency deluge shower station and tell your teacher! Eyes – Wash immediately at the closest eye wash station for minimum of 15 min. Tell your teacher! Desk – Don't touch it! Ask your teacher how to clean it up safely. • When smelling a substance, fan or "waft" the fumes toward you. Never smell directly from a bottle! • When pouring chemicals, keep your face away from the container.
7. Designing and building	• Use the right tool for the job and handle the tools with care. • Read the instructions for using modelling clay. Wash your hands when done. • Read the operating instructions when using mechanical equipment. • Carefully observe and work with moving objects. Tie back loose hair and clothing.

Highlight one or two rules in each section that you think are the most important.
Why did you think they were important?

Science Safety Symbols

Use with textbook pages xv and 97-101.

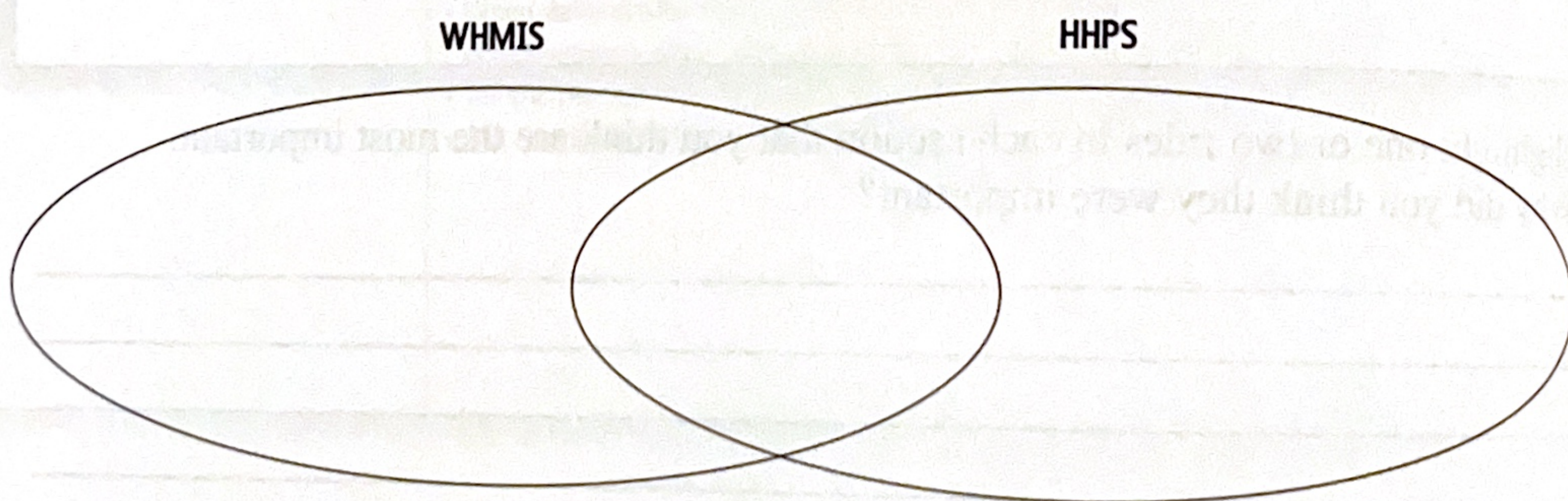
In 2015, Canada updated its method of identifying dangerous materials in the workplace. The new **Workplace Hazardous Materials Information System (WHMIS)** closely follows the United Nations' labelling system called the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). Each chemical also has a Safety Data Sheet (SDS) that gives more detailed information on how the chemical reacts, how it should be stored, and what to do if an accident occurs.

 Exploding bomb (for explosion or reactivity hazards)	 Flame (for fire hazards)	 Flame over circle (for oxidizing hazards)
 Gas cylinder (for gases under pressure)	 Corrosion (for corrosive damage to metals, as well as skin and eyes)	 Skull and Crossbones (can cause death or toxicity with short exposure to small amounts)
 Health hazard (may cause or is suspected of causing serious health effects)	 Exclamation mark (may cause less serious health effects or damage the ozone layer)	 Biohazardous infectious materials (for organisms or toxins that can cause disease in people or animals)

Canada also uses the **Hazardous Household Products Symbols (HHPS)** for items you would use in your home such as hair spray, oven cleaner, and bleach. It was also updated and simplified from the old HHPS system.

The Borders  Dangerous Container The border that looks like a traffic yield sign means that the container is dangerous.	The Hazards  Explosive This symbol means that the container can explode. If it is punctured or heated, pieces can cause serious injuries, especially to the eyes.	 Flammable This symbol means that the product will catch on fire easily if it is near sparks, flames, or even heat.
 Dangerous Product The border that looks like a traffic stop sign means that the contents of the container are dangerous.	 Corrosive This symbol means that the product inside the container will burn the throat or stomach if swallowed and will burn skin or eyes on contact.	 Poisonous This symbol means that the product will cause illness or death if you eat or drink it. For some products, just smelling or licking them is enough to cause serious harm.

Draw a WHMIS and HHPS Venn Diagram to compare and contrast the two systems.



Safety Observations

Use with textbook pages xiv-xvii.

There are many safety problems in the science lab shown below. Highlight as many as you can.



Choose six of the problems you understand the best and number them 1 to 6 on the diagram. For each of the 6 problems, describe what the safety problem is, why it is a problem, and what should be done to fix it.

What is the Problem?	Why is it a Problem?	How to Fix the Problem
1.		
2.		
3.		
4.		
5.		
6.		

How Safe Am I?

Use with textbook pages xiv-xvii.

Each of the following situations could happen in a science classroom.

1. Someone sneezed just as your teacher was telling you about a lab chemical. You read the label, but it was old and partially worn off.

- a) Draw the WHMIS symbols that should be on the label.

Phenolphthalein solution

Avoid contact with eyes and lungs.
Will cause irritation of respiratory tract.
Reproductive toxin. If swallowed, contact doctor immediately. Flammable near an open flame.

- b) List all the safety equipment you should use.

- c) If you accidentally spill this chemical on your hand, what should you do?

2. Two classmates at your lab station are putting on lipstick and eye shadow.

- a) Is this a safety concern for the class? Explain.

- b) What should you do and why?

3. You arrive late to the lab and missed both the lab demonstration and safety talk. Your lab partner is absent and your science binder is in the art class. Since you were the last person to pick up equipment, you were left with two chipped beakers and a broken hot plate.

a) Are *you* a safety concern for the class? Explain.

b) What 2 things should you do immediately?

c) What 3 things should you do for future labs?

4. Hot water is about to boil over on your neighbour's hot plate.

a) Is this a safety concern for the class? Explain.

b) What should you do and why?

What are the characteristics of living things?

Use with textbook pages 6-13.



Check for Understanding

As you read this section, highlight any words or sentences that help you develop your understanding.



Reading Check

What makes something a living thing?

Living or Non-living?

Scientists distinguish between things they consider to be living and things they consider to be non-living. Scientists have come up with a list of characteristics that all living things have in common. To decide whether a thing is living or non-living, scientists judge the thing against the set of characteristics.

To be considered living, a thing must have all the characteristics of life. If even just one characteristic is missing, the thing is judged to be non-living.

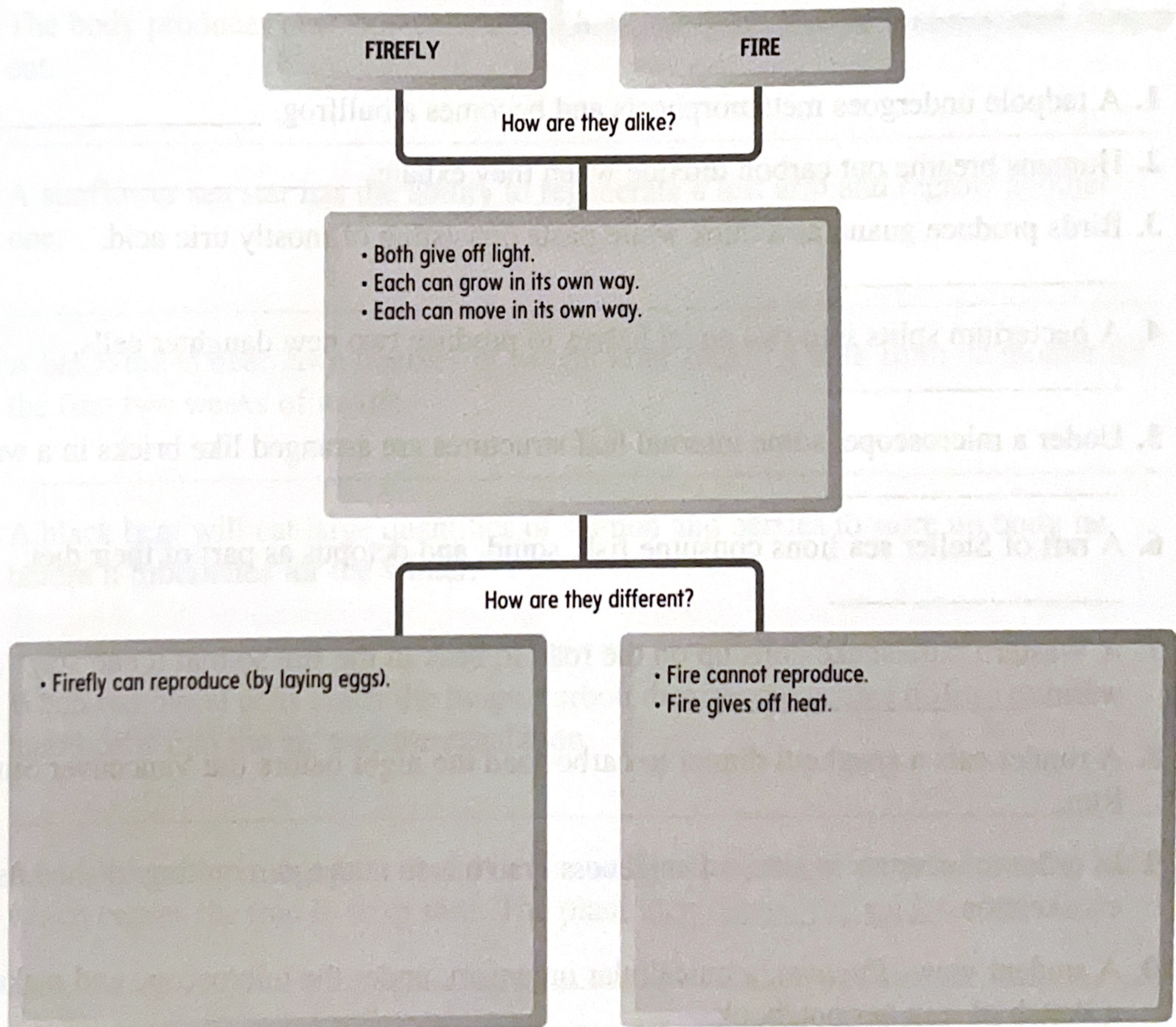
Characteristics of Living Things

Characteristic	Comments
Living things are made of cells.	- Some living things are a single cell. - Some living things have many cells.
Living things take in nutrients.	- Animals and most other living things get nutrients from food by eating other living things. - Green plants and plant-like organisms make their own food.
Living things use energy.	Some nutrients in food are used to provide energy that is needed to live and function.
Living things produce wastes.	- When living things use nutrients, they produce wastes such as carbon dioxide, urine, and feces. - Wastes can cause harm, so they must be removed from cells and/or the body.
Living things respond to stimuli.	- Stimuli is the plural of stimulus. A stimulus is anything that causes a reaction or response. - If you are itchy (<i>stimulus</i>), you scratch the itch (<i>response</i>). If you are tired (<i>stimulus</i>), you rest (<i>response</i>). If you think something is funny (<i>stimulus</i>), you laugh (<i>response</i>).
Living things grow.	"Grow" can mean increasing in size or increasing the number of cells in the body.
Living things reproduce.	- Living things make more of their own kind (species) by reproducing. - Reproduction is not needed for individual living things to survive. Reproduction ensures that the species—the kind of organism a living thing is—will continue to survive.

Living Versus Non-Living

Use with textbook pages 8-11.

1. What distinguishes a living thing from a non-living thing? Some non-living things have some of the same characteristics as living things. Consider a firefly and a fire. Compare and contrast these two things, noting their similarities and their differences in characteristics. Fill in the following Compare and Contrast Graphic Organizer that has been partially completed for you.



2. Explain why one is considered to be living, while the other is considered to be non-living.

Name _____

Date _____

Characteristics of Living Things

Use with textbook pages 8-11.

Identify the characteristic of living things described in each statement. A list of the characteristics is given below.

- | | |
|------------------|-----------------------|
| A. reproduce | E. take in nutrients |
| B. use energy | F. respond to stimuli |
| C. made of cells | G. grow and develop |
| D. produce waste | |

1. A tadpole undergoes metamorphosis and becomes a bullfrog. _____
2. Humans breathe out carbon dioxide when they exhale. _____
3. Birds produce guano as a thick white paste consisting of mostly uric acid.

4. A bacterium splits into two equal halves to produce two new daughter cells.

5. Under a microscope, some internal leaf structures are arranged like bricks in a wall.

6. A raft of Steller sea lions consume fish, squid, and octopus as part of their diet.

7. A Western rattlesnake coils up on the road to bask in the sun so that it can stay warm. _____
8. A runner eats a spaghetti dinner to carbo-load the night before the Vancouver Sun Run. _____
9. In order to increase in size, a Dungeness crab has to undergo moulting to shed its exoskeleton. _____
10. A student views *Euglena*, a unicellular organism, under the microscope and makes a sketch of it in her notebook. _____
11. Thousands of spawning salmon can be seen swimming upstream along the Adams River in Kamloops to lay and fertilize their eggs. _____
12. The European wall lizards on the Saanich Peninsula eat lots of insects to have enough energy for their active lifestyle jumping. _____

Interdependent Characteristics

Use with textbook pages 8-11.

Identify two characteristics of living things that are interdependent because they are closely related in each scenario described below.

1. Sunflowers are known to follow and face the Sun as they grow.

2. The body produces new skin cells through cell division to help seal a wound from a cut.

3. A sunflower sea star has the ability to regenerate a lost arm and regrow another one.

4. A black-tailed deer fawn doubles in weight after suckling milk from its mother for the first two weeks of its life.

5. A black bear will eat large quantities of salmon and berries to store up body fat before it hibernates for the winter.

6. When red blood cells reach the lungs, carbon dioxide molecules diffuse out of blood cells into the air sacs for exhalation.

7. As a spider crawls along the leaf of a Venus flytrap, it triggers the hair on the leaf, which causes the trap to snap shut. The plant then digests the spider.

8. A tree absorbs nutrients and water from the soil, takes in carbon dioxide from the atmosphere, and captures the Sun's energy to produce food and oxygen through the process of photosynthesis.

Name _____

Date _____

Investigating Growth and Development

Use with textbook pages 9.

Will adding nitrogen fertilizer to soil affect the growth and development of radish plants? Two students designed an experiment to find out. They got three pots to grow the seeds. Each pot got 400 mL of potting soil from the same bag.

- They added 2 g of fertilizer to the soil of one pot and labelled it Pot A.
- They added 4 g of fertilizer to the soil of a second pot and labelled it Pot B.
- They added 6 g of fertilizer to the soil of a third pot and labelled it Pot C.

Five radish seeds were placed at the same depth in each pot. All the pots were exposed to the same amount of sunlight and given the same amount of water for 6 days. They measured and recorded the height of the tallest seedling in each pot each day.

Data Table

Day	Height of Tallest Seedling (mm) in Pot A	Height of Tallest Seedling (mm) in Pot B	Height of Tallest Seedling (mm) in Pot C
1	0	0	0
2	3	5	7
3	6	10	16
4	9	16	26
5	12	23	38
6	15	30	60

- If the students were to create a graph to display the data, what variable would be placed on the x -axis? What would be placed on the y -axis?

- State the hypothesis being investigated for this experiment.

- What variables were kept the same in this experiment?

- Identify an error in the experimental design.

- What must the students do for their results to be considered valid?

1.1 Assessment

Match each term on the left with the best description on the right. Each description may be used only once.

Term	Description
1. ____ cell	A. the basic unit of life
2. ____ producer	B. an organism made up of one cell
3. ____ consumer	C. an organism made up of many cells
4. ____ internal stimulus	D. an organism that must eat other organisms to get nutrients
5. ____ external stimulus	E. has the ability to produce its own food using the Sun's energy
6. ____ unicellular organism	F. something from inside an organism that causes the organism to respond
7. ____ multicellular organism	G. a change from the external environment that causes an organism to respond

Circle the letter of the best answer for questions 8 to 16.

8. Which of the following organisms relies on other organisms for energy and nutrients?
- A. moss
B. algae
C. apple tree
D. snowy owl
9. Which of the following terms is incorrectly paired with the example?
- A. unicellular organism—head louse
B. producer—Western Red Cedar tree
C. consumer—Vancouver Island marmot
D. multicellular organism—Pacific Dogwood tree
10. Hunger and thirst are two examples of
- A. life processes
B. internal stimuli
C. external stimuli
D. sources of energy
11. Which of the following is an example of an external stimulus?
- A. An athlete starts to sweat to cool down.
B. A student starts to feel sleepy after a long day.
C. A student notices his heart rate goes up after climbing a flight of stairs.
D. A geranium plant does not have a lot of starch stored in its leaves after being placed in a dark room for several days.

12. Which of the following scenarios are examples of “response to a stimulus”?

I	<i>Euglena</i> excretes water and waste through a vacuole.
II	The leaves of a sleepy plant shrink when they are touched.
III	<i>Paramecium</i> moves away from the cooler water toward the warmer water.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II, and III

13. A female frog can release up to 4000 eggs at one time during mating season. What characteristics of life are described by this statement?

I	Living things reproduce.
II	Living things use energy.
III	Living things produce waste products.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II, and III

14. A grasshopper sheds its exoskeleton through moulting in order to increase in size. With what characteristic of living things would moulting be associated?

- A. reproduction
- B. made of cells
- C. producing waste
- D. growth and development

15. A conservation officer points out some black bear scat (droppings) to a group of students. Bear scat is associated with which two characteristics of living things?

- A. using energy and reproduction
- B. reproduction and response to stimuli
- C. taking in nutrients and producing waste
- D. growth and development and made of cells

16. A student wanted to carry out an experiment using pea seeds to see the effects of different environmental factors on rate of plant growth over several weeks. Which of the following factors would not be considered a variable in this experiment?
- A. light intensity
 - B. soil temperature
 - C. type of pea seeds
 - D. amount of road salt added to the soil

17. Complete the T-chart to compare and contrast “From what do living things get their energy?” and “For what do living things use the energy?”

From what do living things get their energy?	For what do living things use the energy?
• producers get energy from sunlight	• life processes

Where do living things come from?

Use with textbook pages 14–21.

Reading Check

1. What is the cell theory?

2. Why do scientists think viruses might be living things?

In Your Own Words

Highlight the three main ideas of the cell theory. Put each idea in your own words.

Check For Understanding

As you read about viruses, highlight the parts that help you understand what a virus is.

The Cell Theory

The invention of the microscope let scientists discover cells. Over a period of about 200 years, scientists studied cells in great detail. These studies helped scientists develop the *cell theory*. The *cell theory* is a set of three statements that explain what living things are made up of and where they come from.

- ◆ **Statement 1:** All living things are made up of one or more cells. This is one of the characteristics of living things. (Refer to page 8 in your textbook.)
- ◆ **Statement 2:** All new cells come from pre-existing cells. This is a different way of saying that living things reproduce—another characteristic of living things. (Refer to page 11 in your textbook.)
- ◆ **Statement 3:** The cell is the basic unit of life. This means that the cell is the most simple thing that has all the characteristics of living things. If a thing is missing even just one of those characteristics, it is not a cell.

Viruses—Living, Non-living, or Something Else?

A virus is a strand of genetic material encased in a protective coating of protein—a protein coat. A virus has just one of the characteristics of living things: It can reproduce. But, a virus cannot reproduce on its own. It must enter and take over a living cell so that it can reproduce.

Most scientists used to think that viruses are not living things. This view may be changing. The table outlines why.

Why Scientists' View of Viruses May Be Changing

What Scientists Have Learned Recently About Viruses	Comments
New, very large viruses are discovered.	These viruses have more genetic material than other known viruses. Some of it has never been seen before in viruses.
The new viruses and genetic material are studied and compared with known viruses.	Studies suggest that viruses might have been more like living cells long ago in Earth's ancient past. As time passed, viruses might have evolved to become the kinds of things they are today.